Early aftershocks dei terremoti: Mw 6.0 Amatrice, Mw 5.9 Visso e Mw 6.5 Norcia

D. Latorre, L. Improta, L. Margheriti, A. Marchetti, A. Nardi, B. Castello, A. M. Lombardi, F.M. Mele, M. G. Ciaccio, M. Moretti, e il Gruppo di lavoro del **Bollettino Sismico Italiano***

Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italia

(lucia.margheriti@ingv.it)

Bollettino Sismico Italiano (BSI) http://cnt.rm.ingv.it/bsi

Working Group A. Nardi, A. Marchetti, F. M. Mele, D. Latorre, P. Battelli, M. Berardi, C. Castellano, C. Melorio, G. Modica, M. Pirro, A. Rossi, C. Thermes, N. Pagliuca, A.M. Lombardi, M. Moretti, L. Improta, S. Spadoni, L. Arcoraci, A. Battelli, A. Lisi, L. Pizzino, P. Baccheschi, B. Cantucci, M.G. Ciaccio, B. Castello, A. Sciarra, A. Bono, C. Marcocci, V. Lauciani, A. Mandiello, S. Pintore, M. Quintiliani, A. Frepoli, D. Cheloni, L. Colini, S. Pinzi, L. Scognamiglio, A. Basili, F. Villani, G. D'Addezio, L. Alfonsi, T. Sgroi, A. Smedile, C. Montuori, R. Tardini, R. Tozzi, S. Monna, M.T. Mariucci, R. Di Maro, L. Margheriti.

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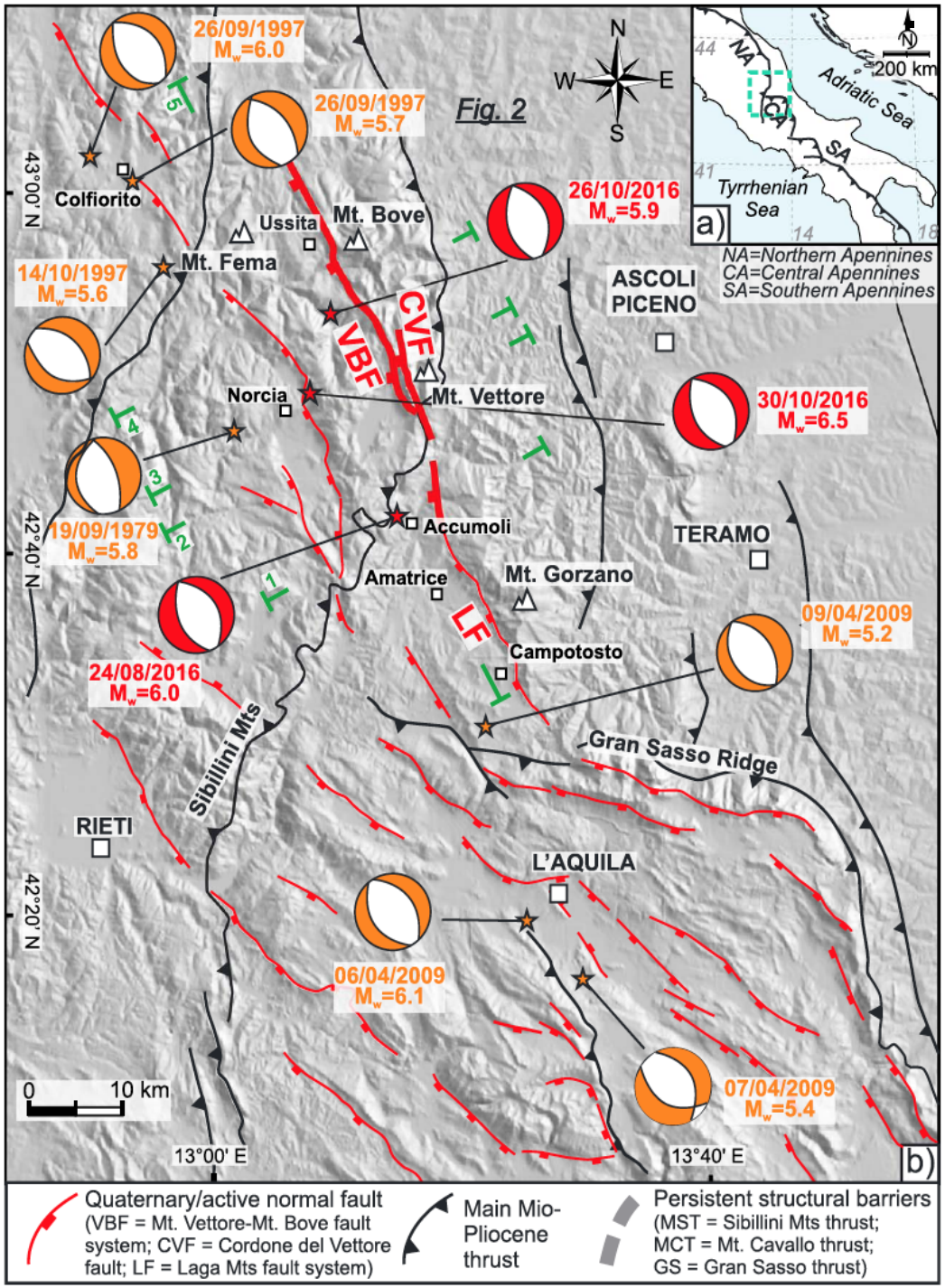
Seismotectonic sketch and complex multi-segment rupture models



Sketch from

Walters R.J. , L.C. Gregory, L.N.J. Wedmore, T.J. Craig, K. McCaffrey, M. Wilkinson, J. Chen, Z. Li, J.R. Elliott, H. Goodall, F. Iezzi, F. Livio, A.M. Michetti, G. Roberts, E. Vittori (2018). Earth and Planetary Science Letters, https://doi. org/10.1016/j.epsl.2018.07.043.

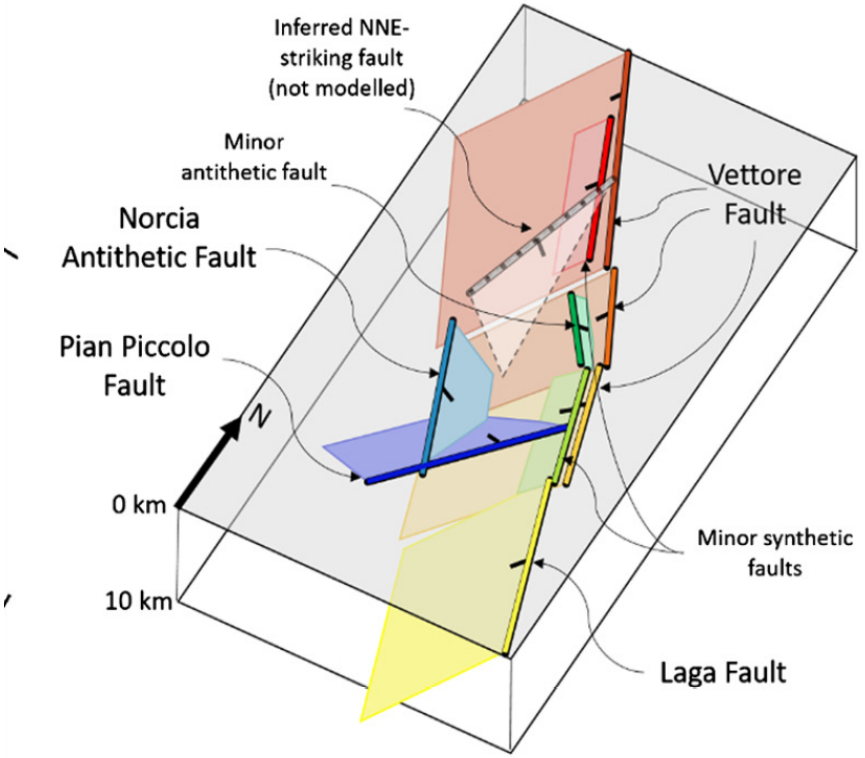
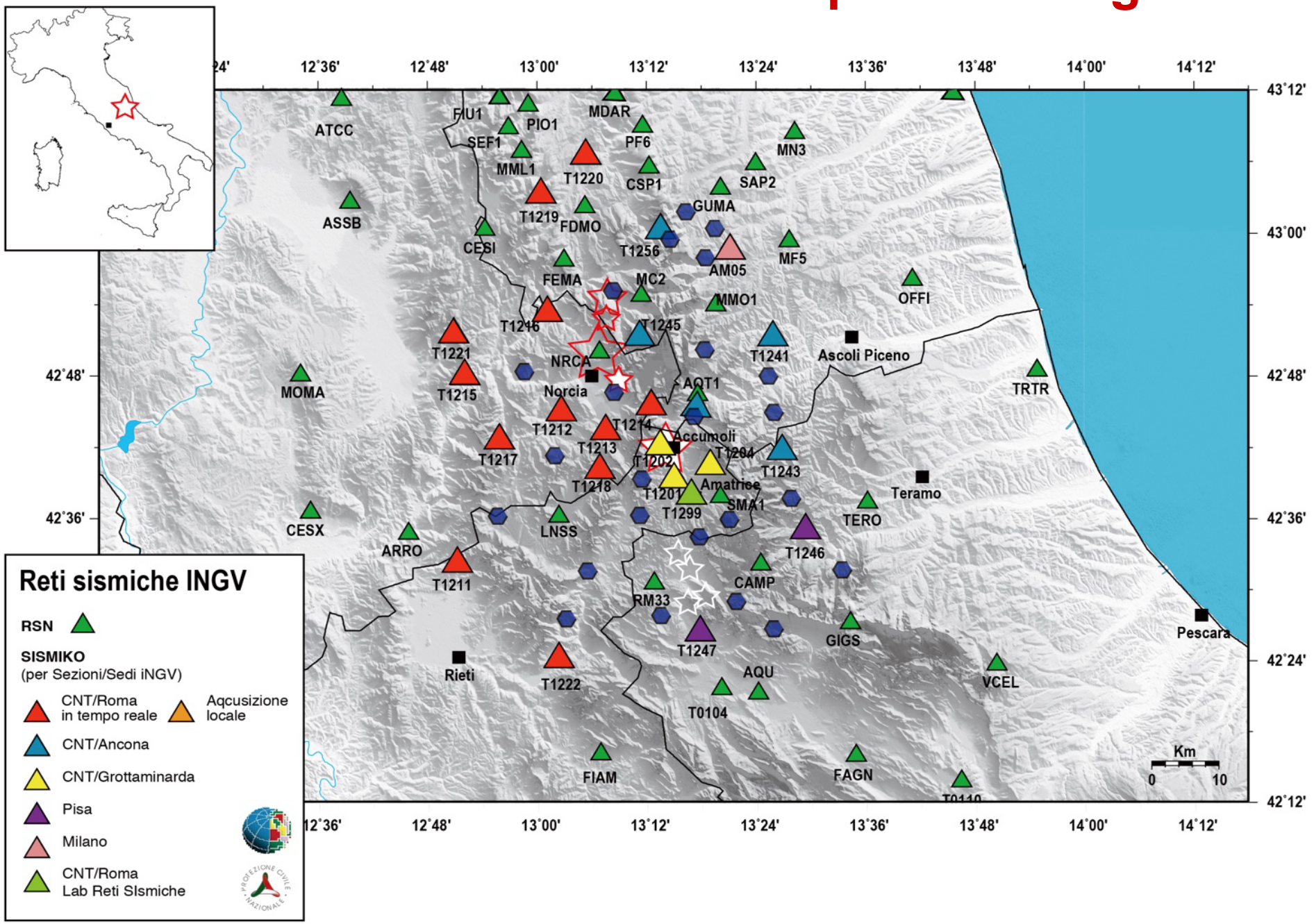


Figure from

Pizzi, A., Di Domenica, A., Gallovič, F., Luzi, L., & Puglia, R. (2017). Tectonics, 36, 2370–2387. https://doi.org/10.1002/2017TC00465

Seismic network in the epicentral region



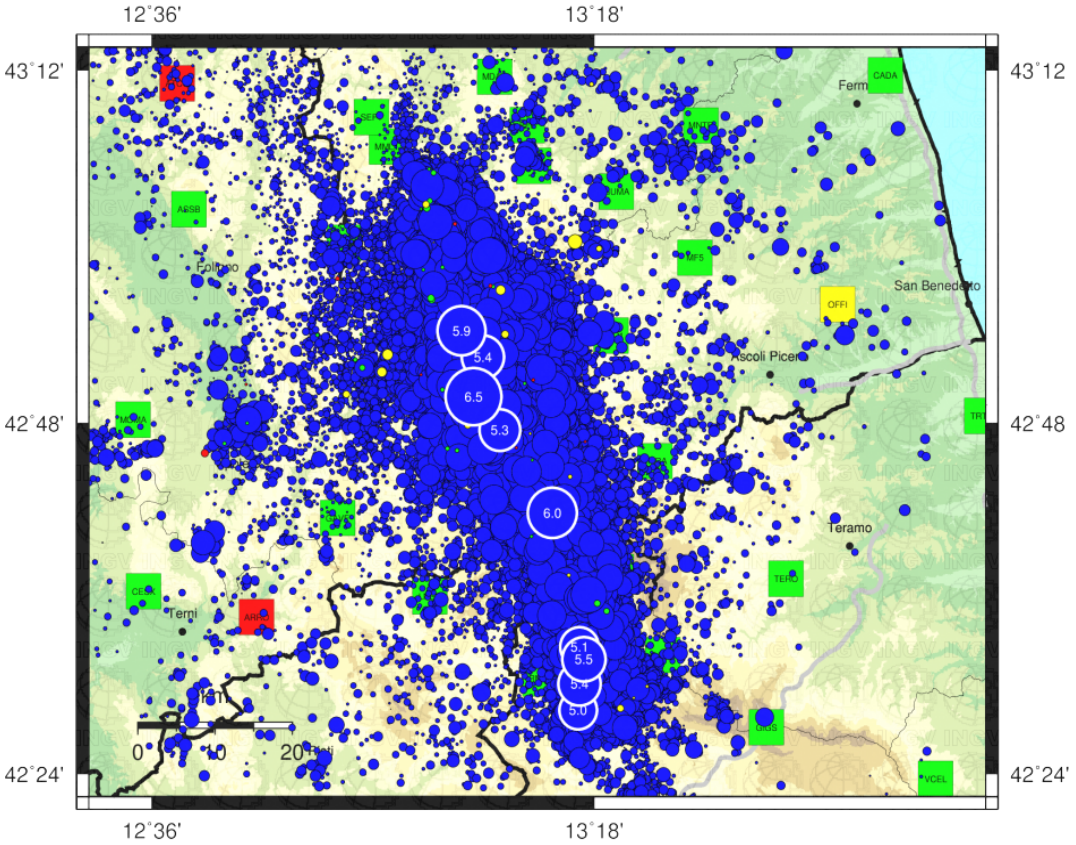
by SISMIKO(24) EMERSITO (22) RAN-DPC (10) BGS (25 BB)

ISIDe: the seismic sequence today:

http://cnt.rm.ingv.it/iside *DOI: 10.13127/ISIDe*

Mappa Epicentrale della Sequenza Sismica

per il periodo 24–08–2015 : 14–11–2018



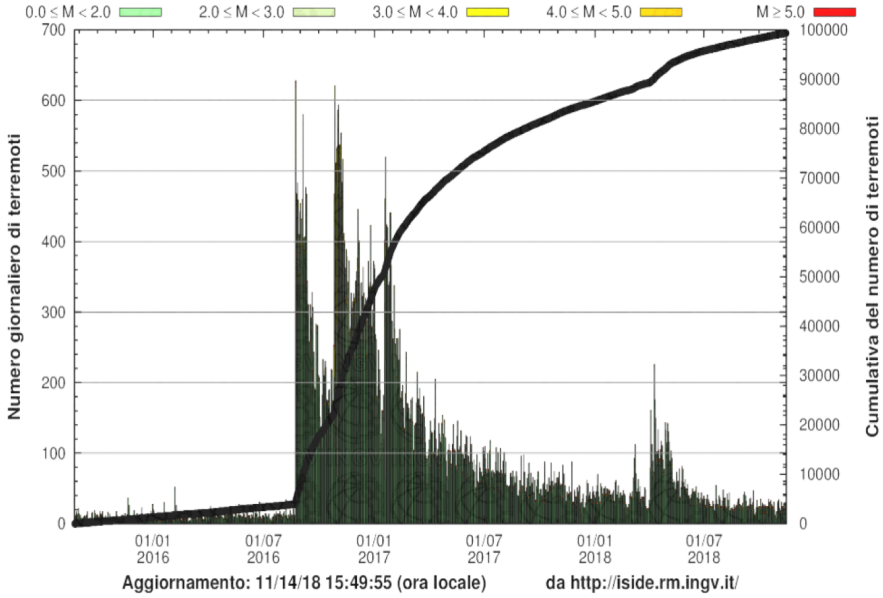
Aggiornata al 2018–11–14,08:00:00 UTC, numero di eventi 99344

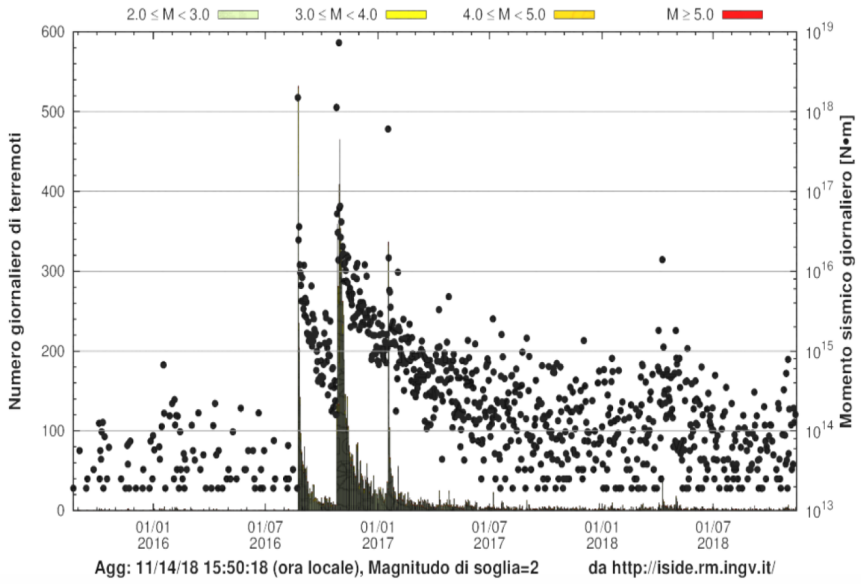
	Oggi	Ieri	2gg fa	Precedenti
Ml < 3.0	10	21	30	98068
3.0 <= Ml < 4.0	0	0	0	1143
4.0 <= Ml < 5.0	0	0	0	67
Ml >= 5.0	0	0	0	9

Stato della rete

Funzionante Parzialmente funzionante Guasta

(http://iside.rm.ing

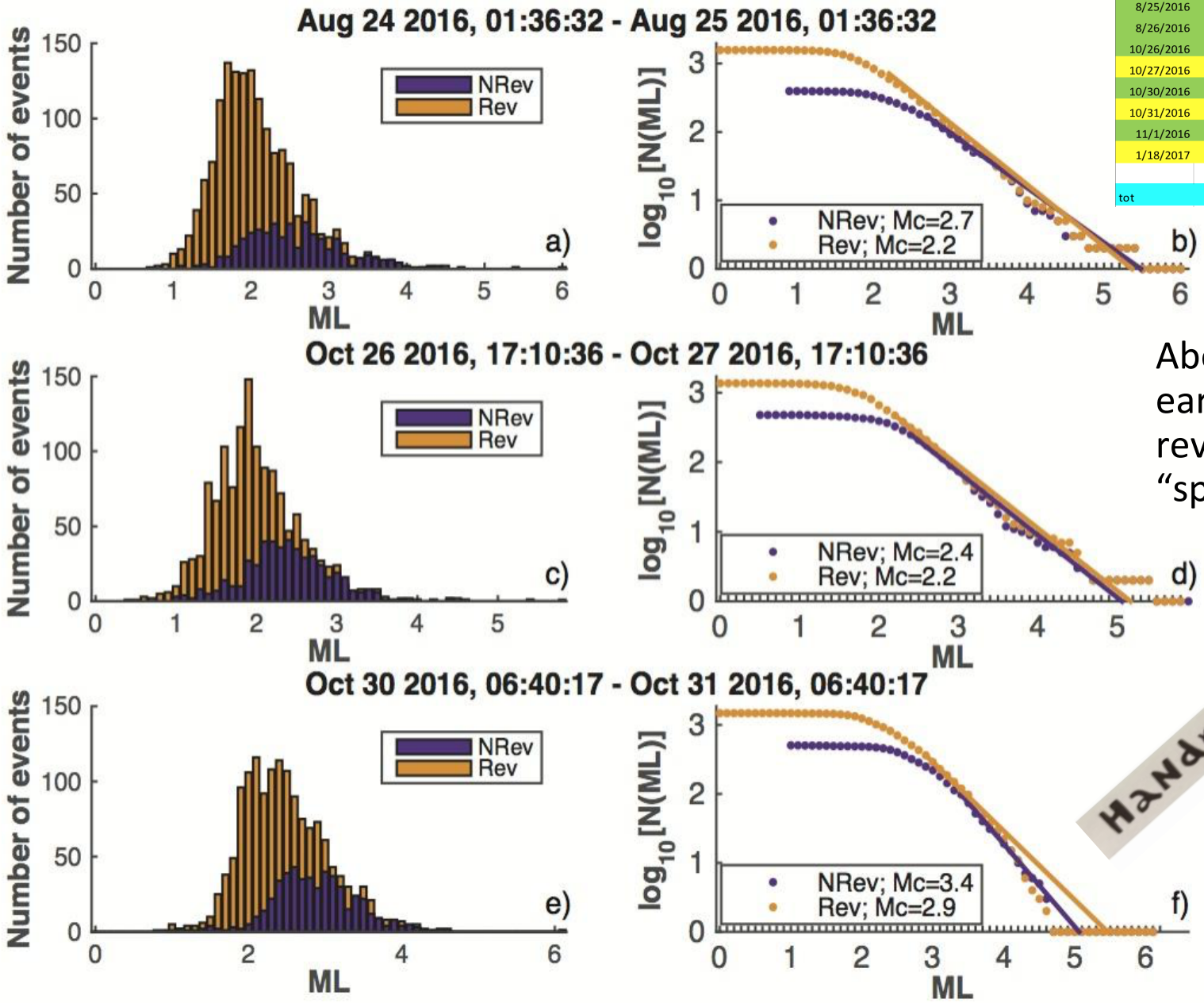




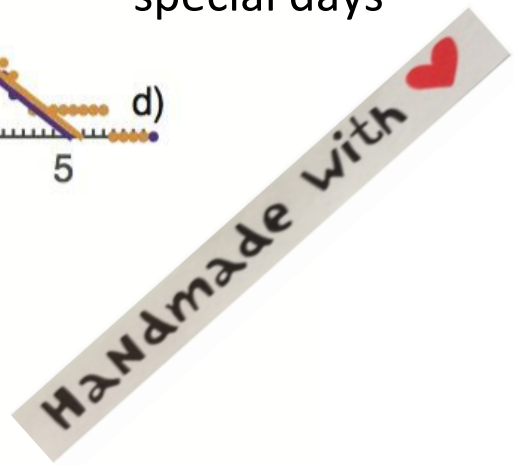
Il Bollettino Sismico Italiano (BSI) reviewed the early aftershocks of the 3 mainshocks August 24th, October 26th and 30th 2016

Event Number and magnitude

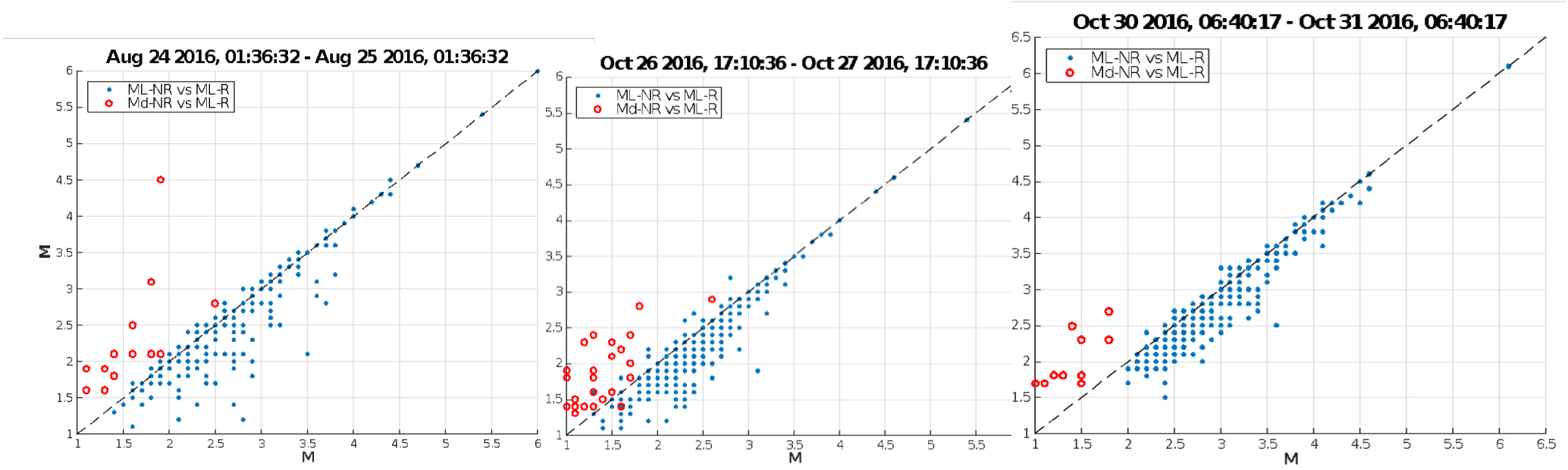
BEST	900	1000	100	tot
8/24/2016	1061	415	0	1476
8/25/2016	1278	4	0	1282
8/26/2016	1242	5	0	1247
10/26/2016	609	23	0	632
10/27/2016	1156	11	0	1167
10/30/2016	1235	113	0	1348
10/31/2016	1830	7	0	1837
11/1/2016	1599	10	0	1609
1/18/2017	752	27	0	779
tot	10734	615	0	11377



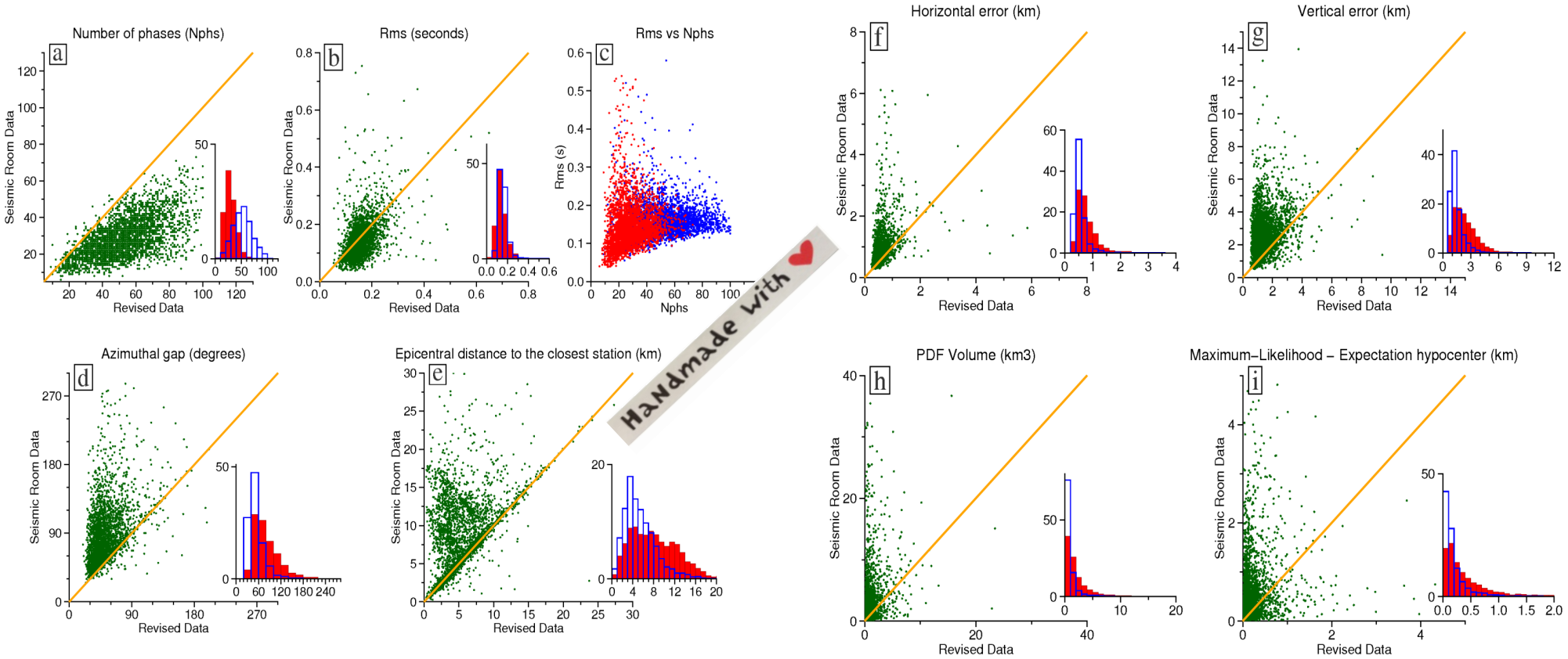
About 10.600 early aftershocks revised in the "special days"



Reviewed magnitude and consequent improvements of the tools for evaluating the M_L during sequences in surveillance room

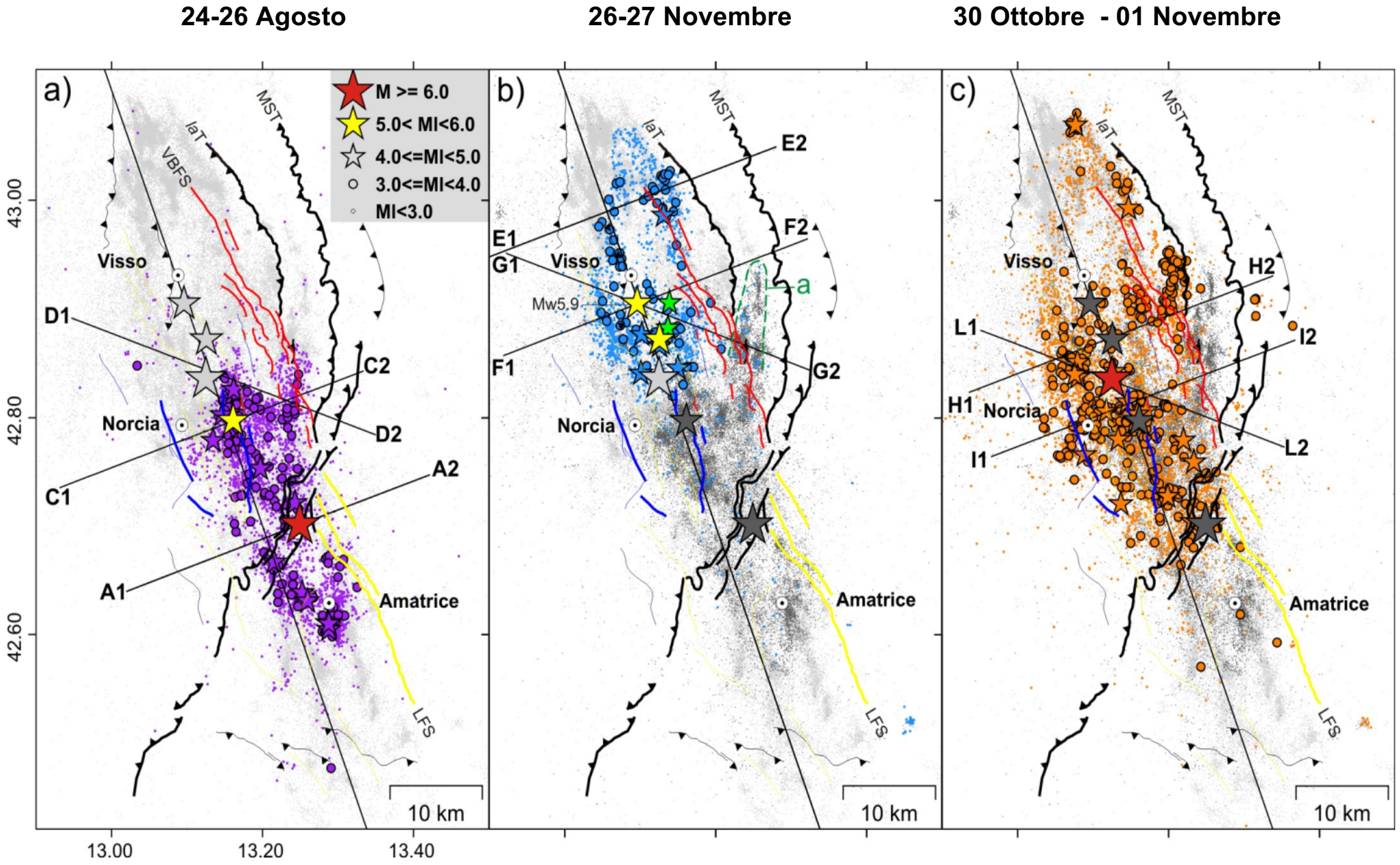


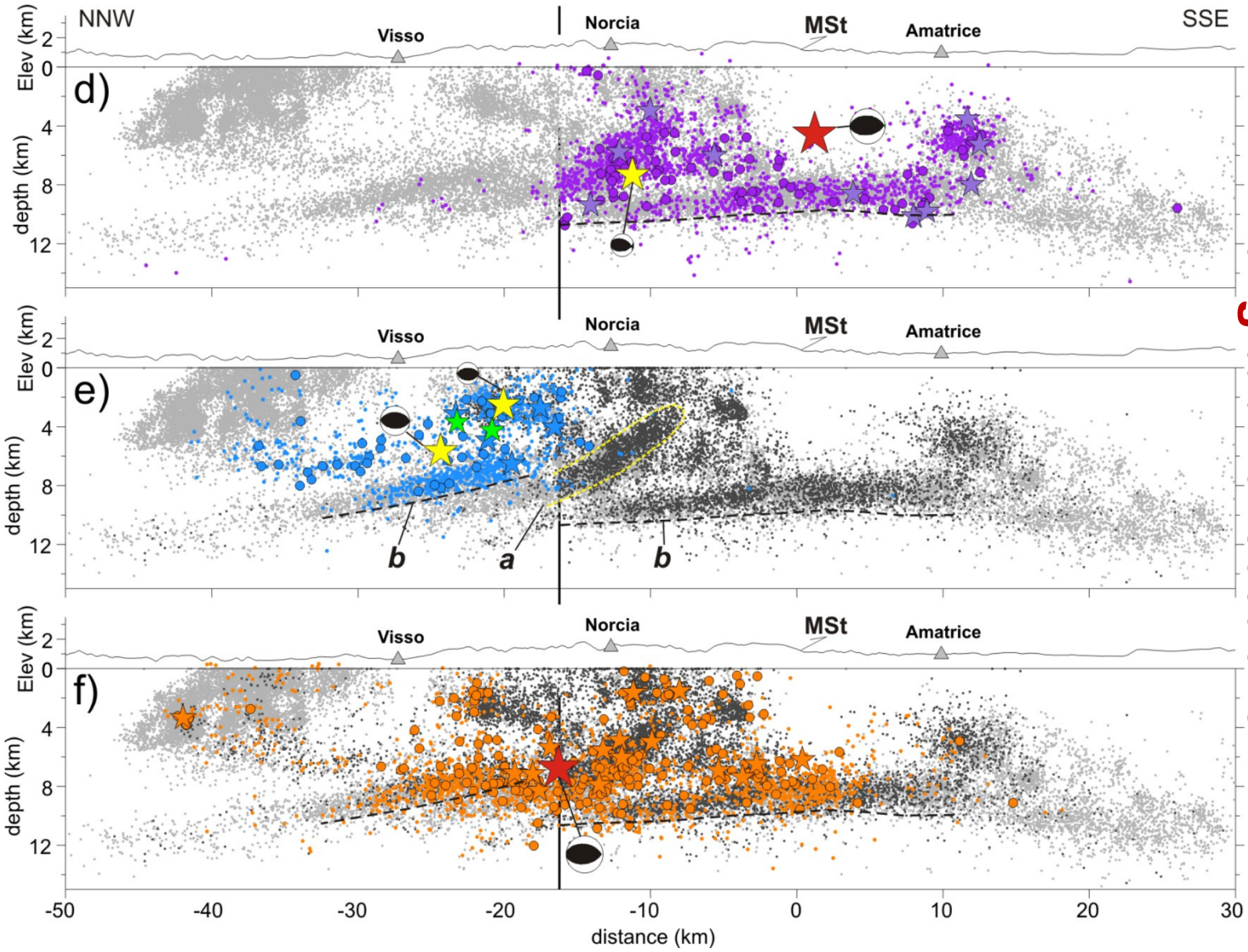
Location quality parameters of the revised earthquakes



The **strong increase of the phase picks** number causes reduction of the azimuthal gap and epicentral distance of the closest station that control horizontal and vertical location uncertainties, respectively. **High-quality of the catalog**: 80% of hypocentral locations has rms lower than 0.12 s, azimuthal gap lower than 89°, horizontal and vertical formal location errors smaller than 0.6 and 2 km, respectively. The revised data allows to constrain the hypocentral locations, being also able to correctly resolve very shallow (1-3 km depth) earthquakes, as those located along and east of the VBFS.

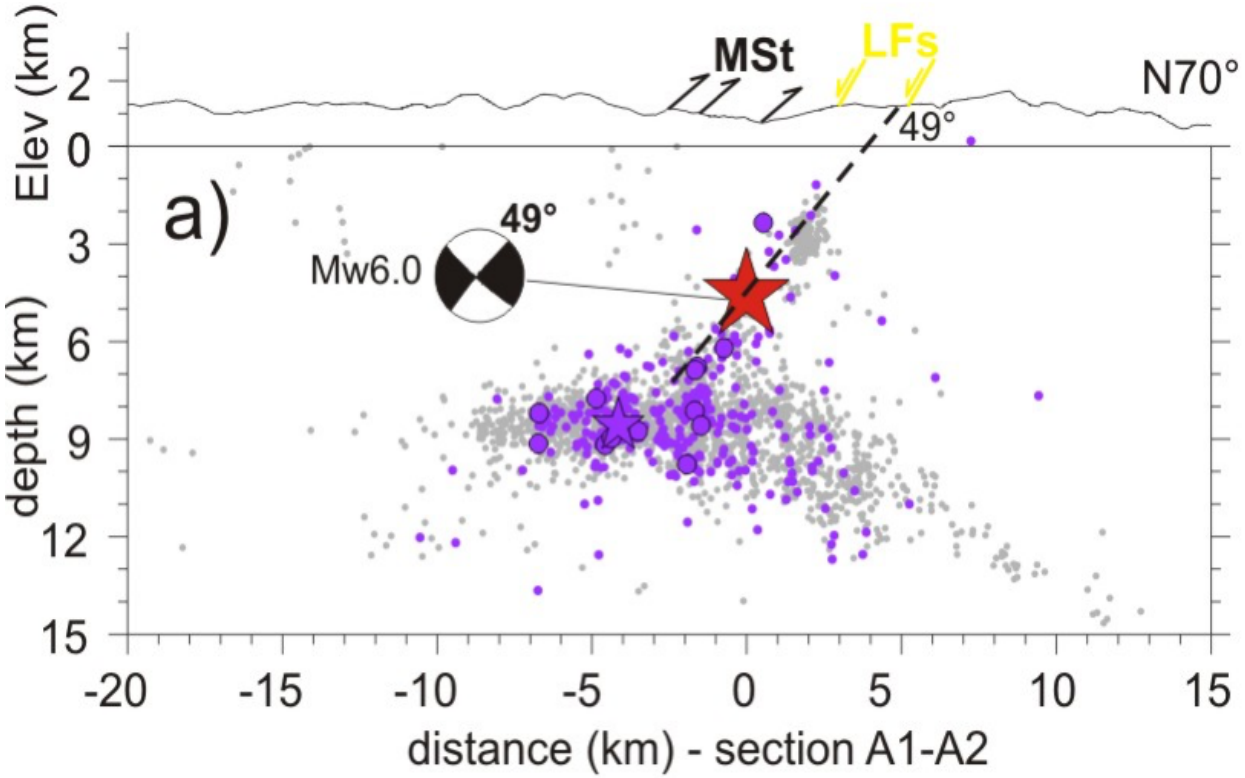
Early aftershocks - maps

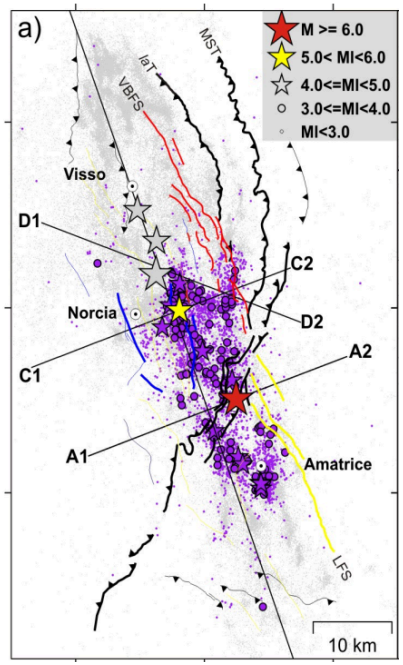


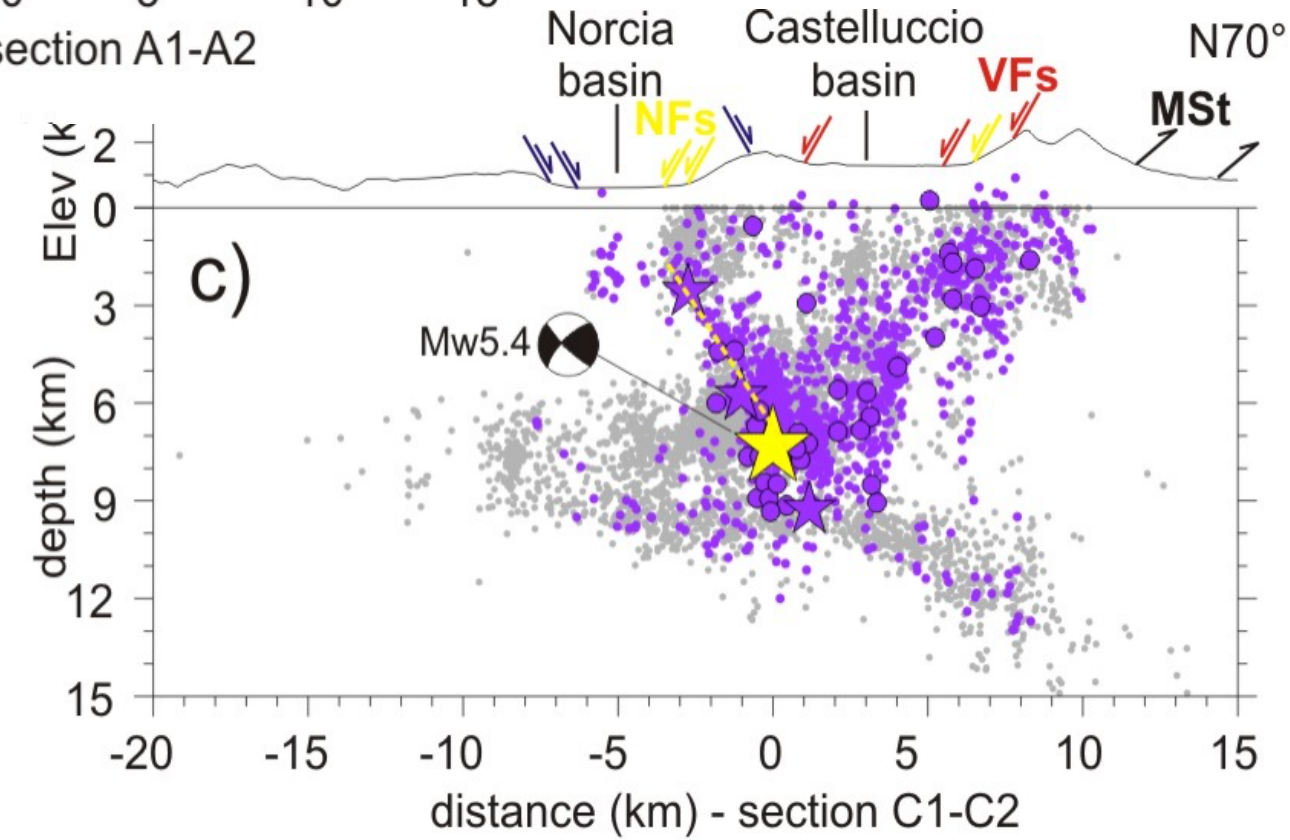


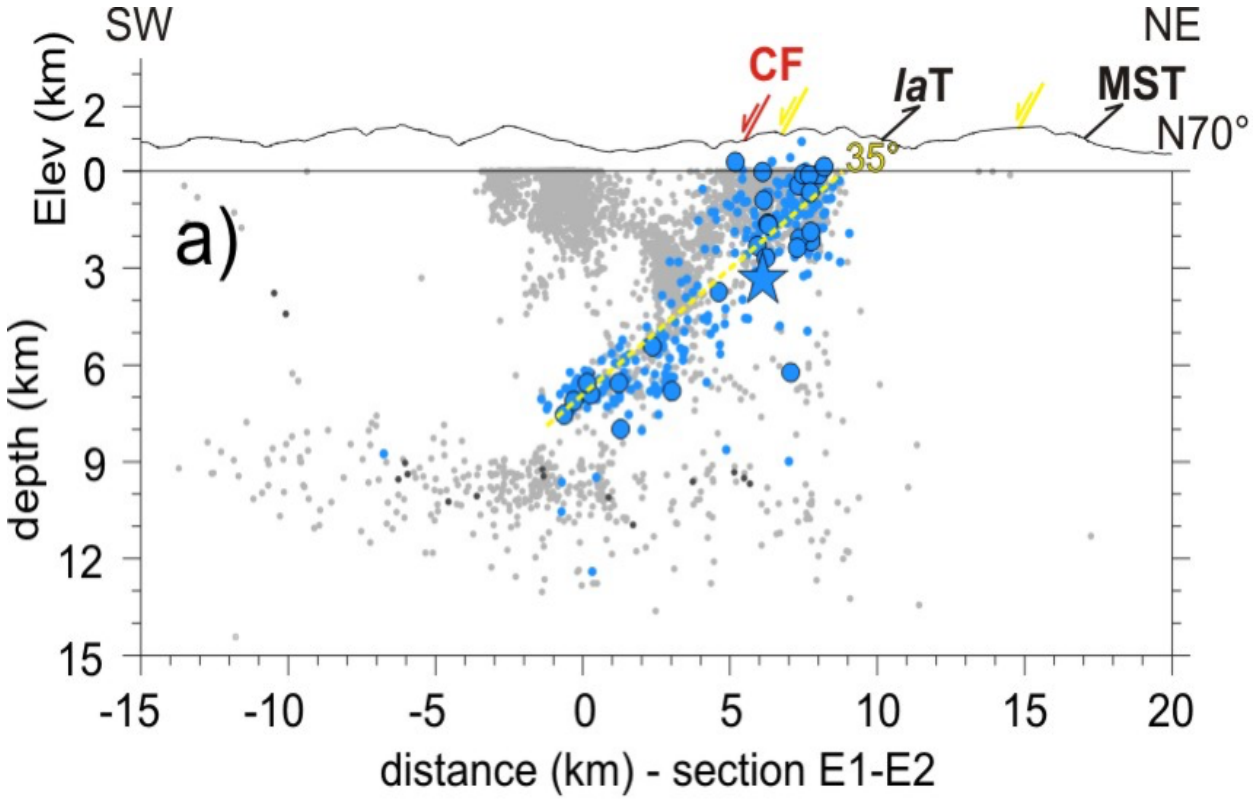
Early aftershocks - longitudinal sections

Amatrice Earthq. early aftershocks August 24th-26th 2016

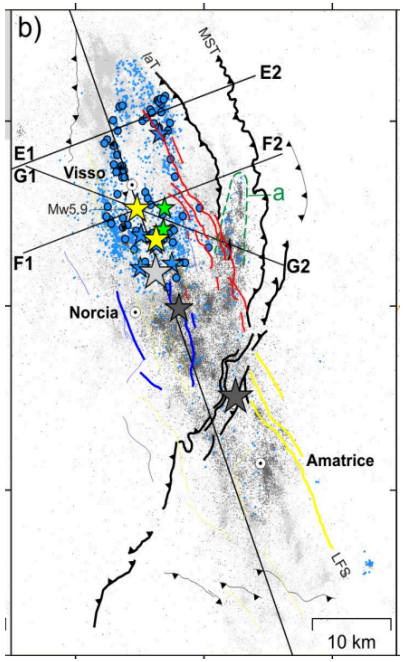


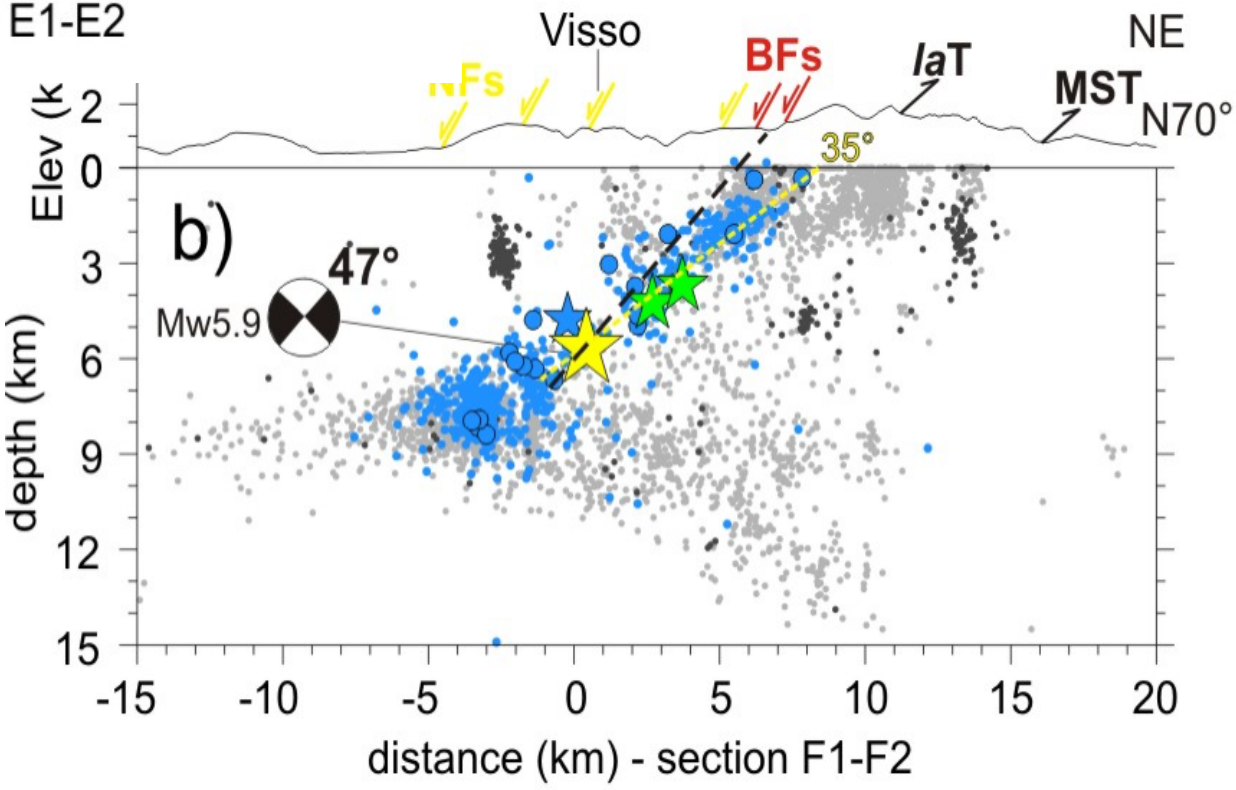


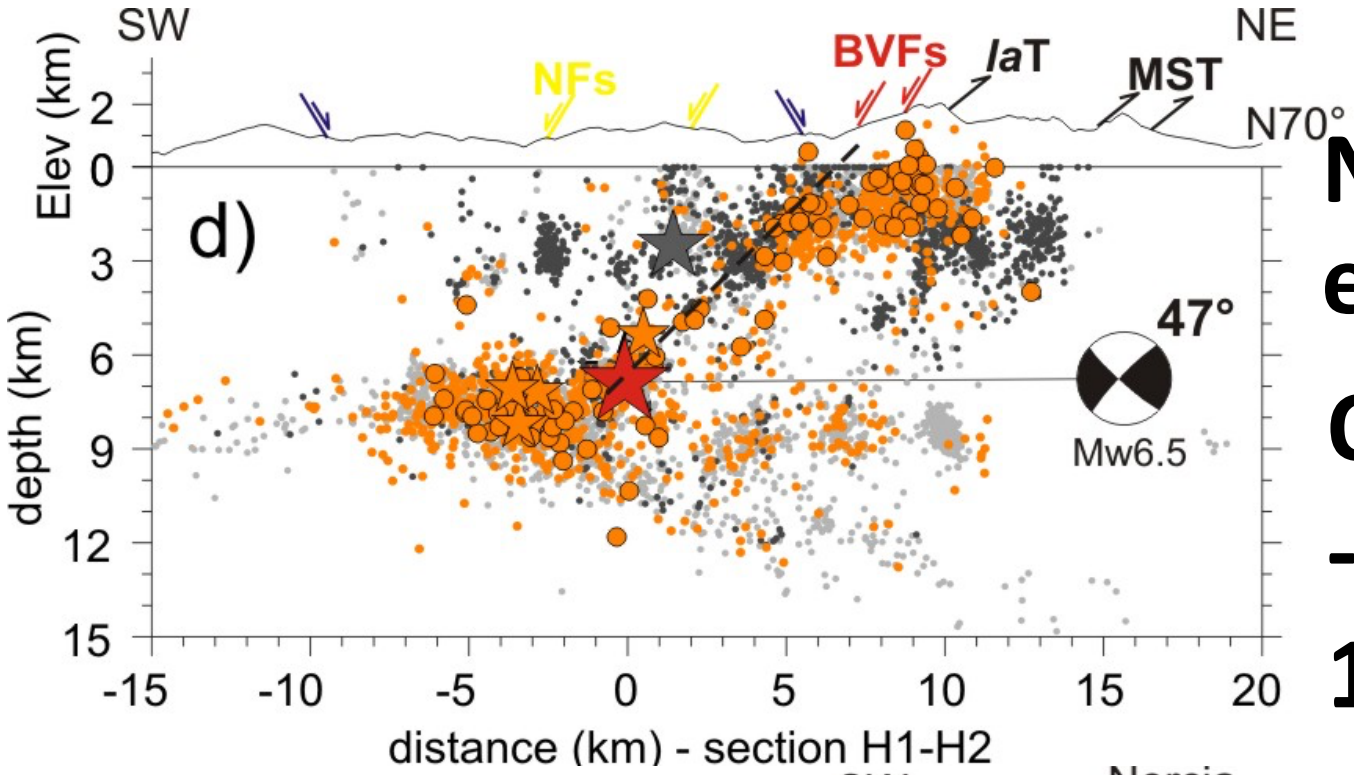




Visso Earthq. early aftershocks October 26th-27th 2016

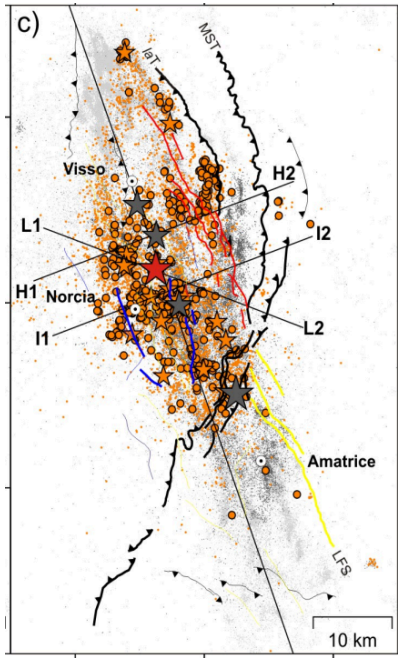


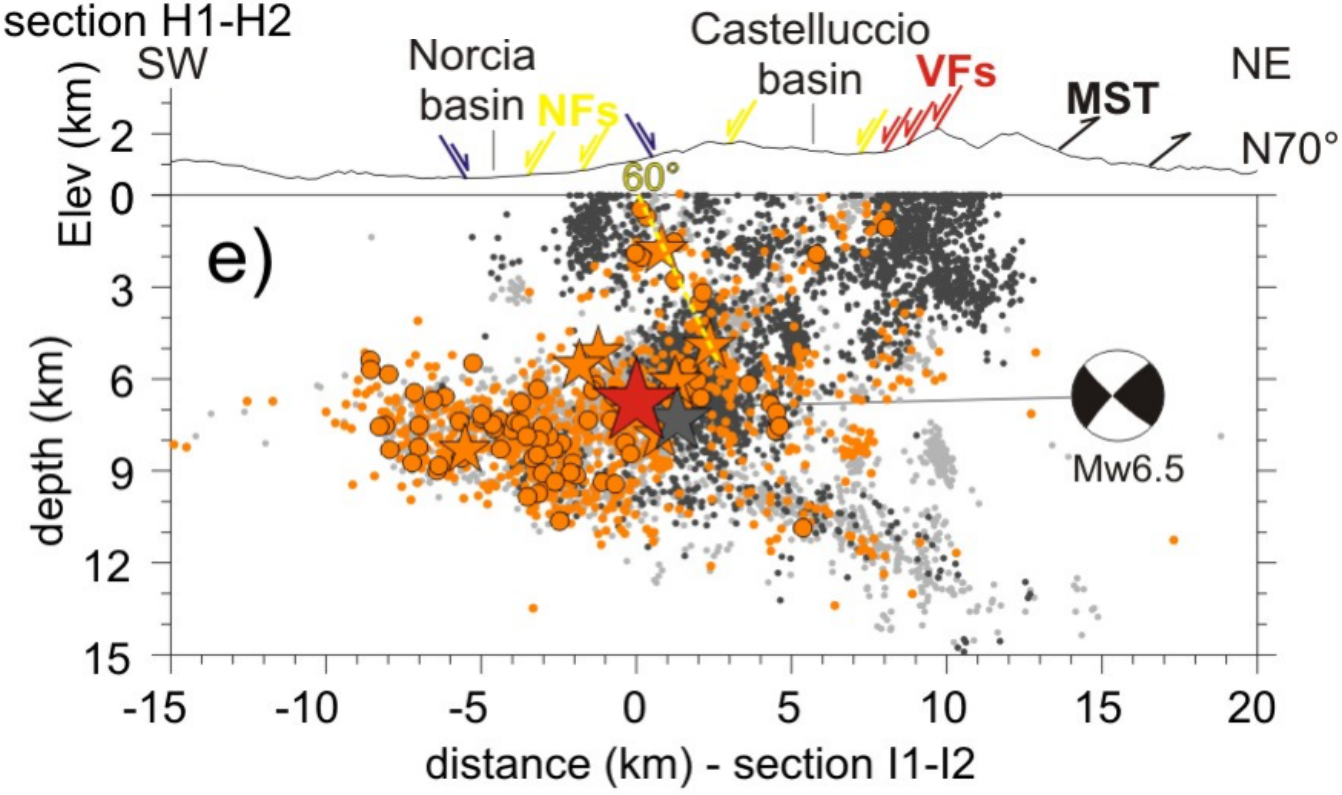




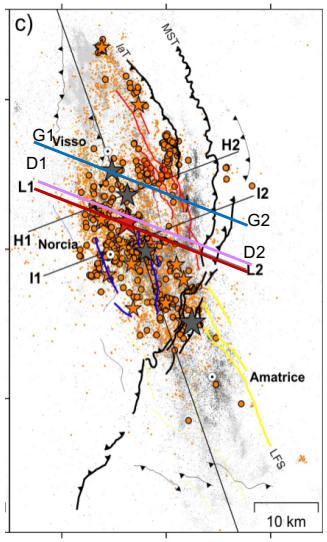
Norcia Earth. early aftershocks

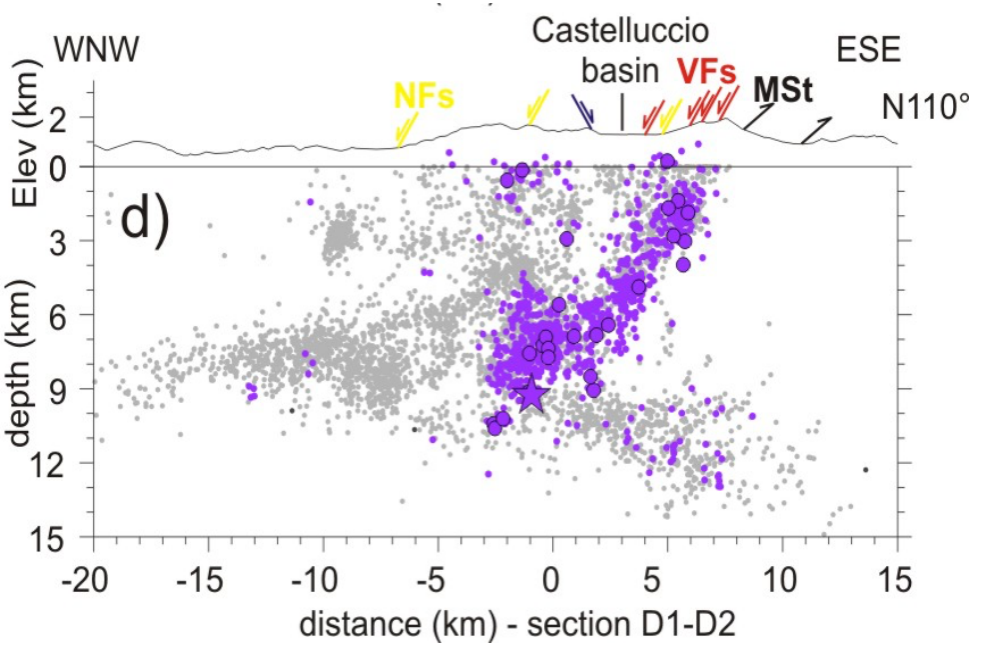
October 30th - November 1st 2016

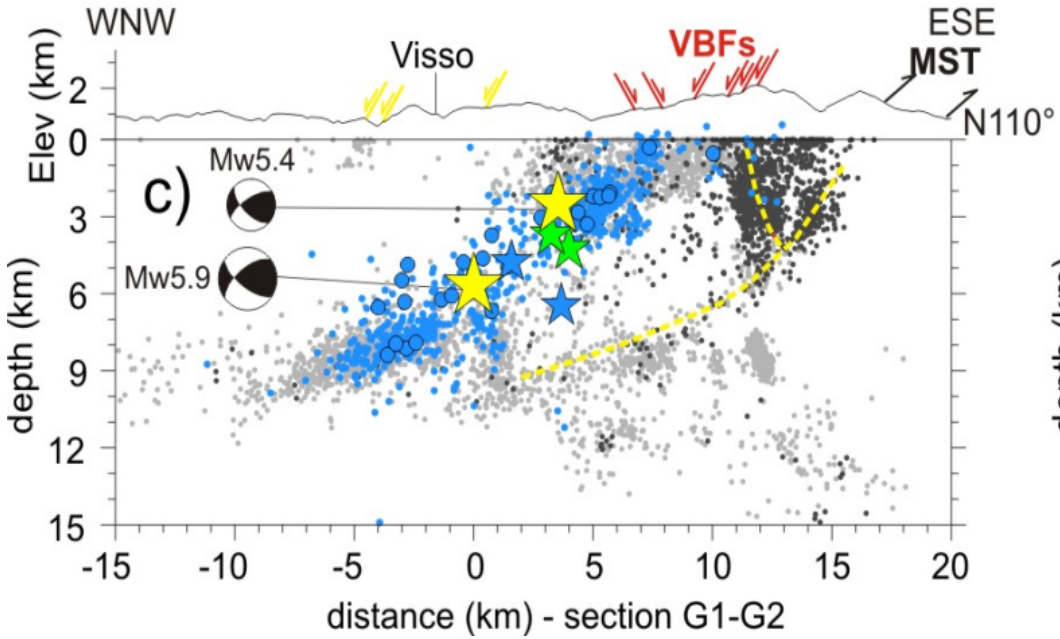


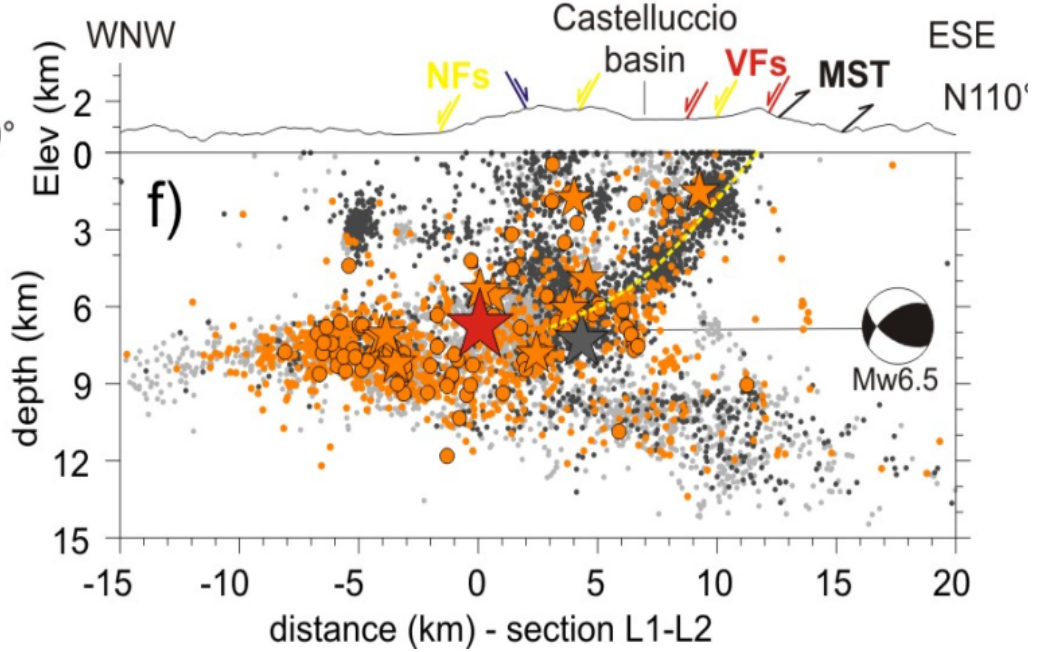


Role of the compressional tectonic elements









Conclusions

- We provide high-quality early aftershocks hypocentral locations' catalogue: Mainshocks locations and pickings, early aftershock locations (pickings are going to be available in ISIDe http://cnt.rm.ingv.it/iside *DOI: 10.13127/ISIDe*

- The catalogue gives new constraints on the normal faults activated and the thrust reactivated during the Amatrice Visso Norcia mainshocks and on the complex multi-segment rupture models of the Norcia Earthquake.

- The fault illuminated by the improved aftershock distribution can be compared to structures imaged by seismic reflection profiles to constrain the tectonic structure of the area

Thank you for your attention

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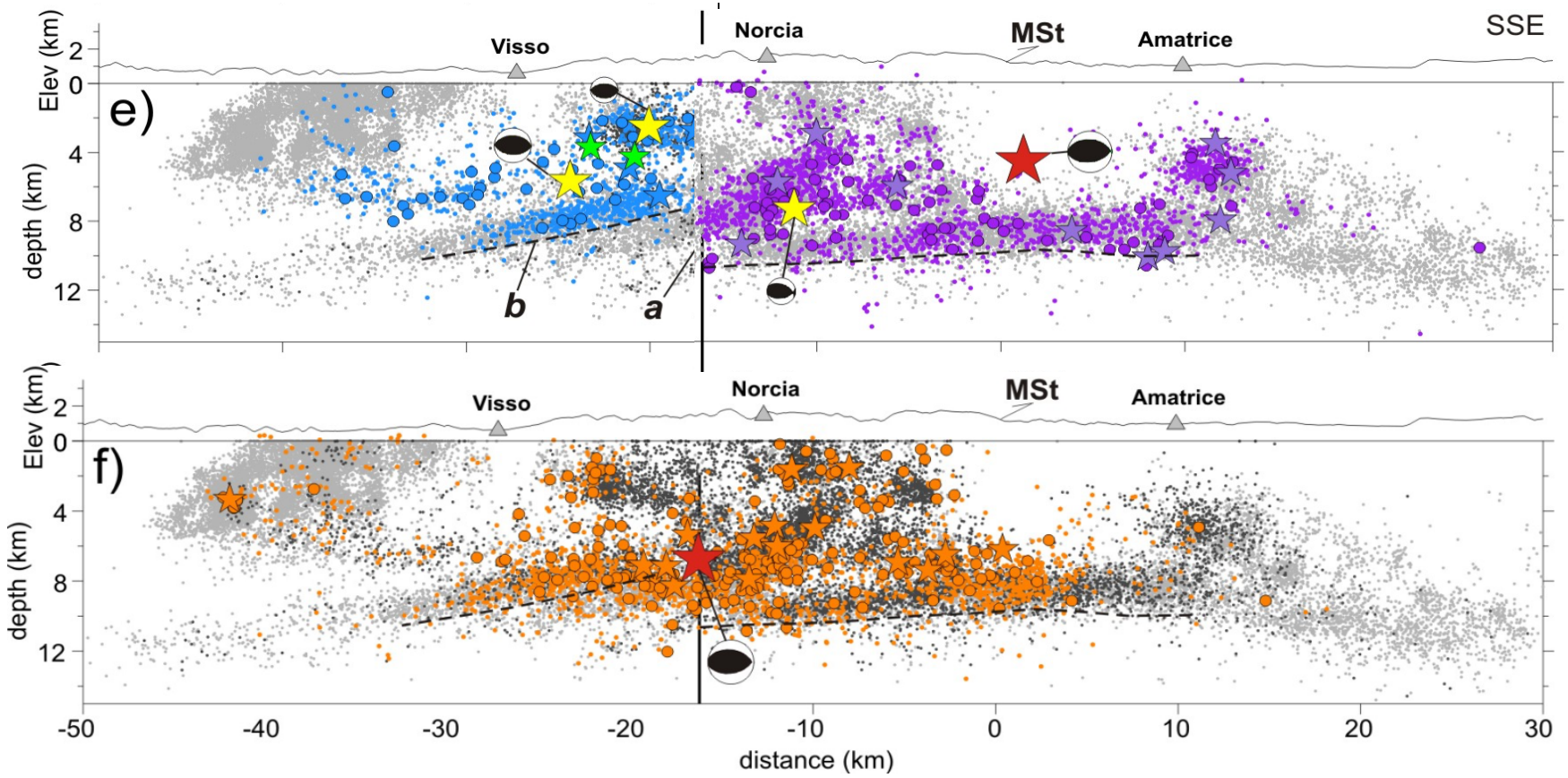
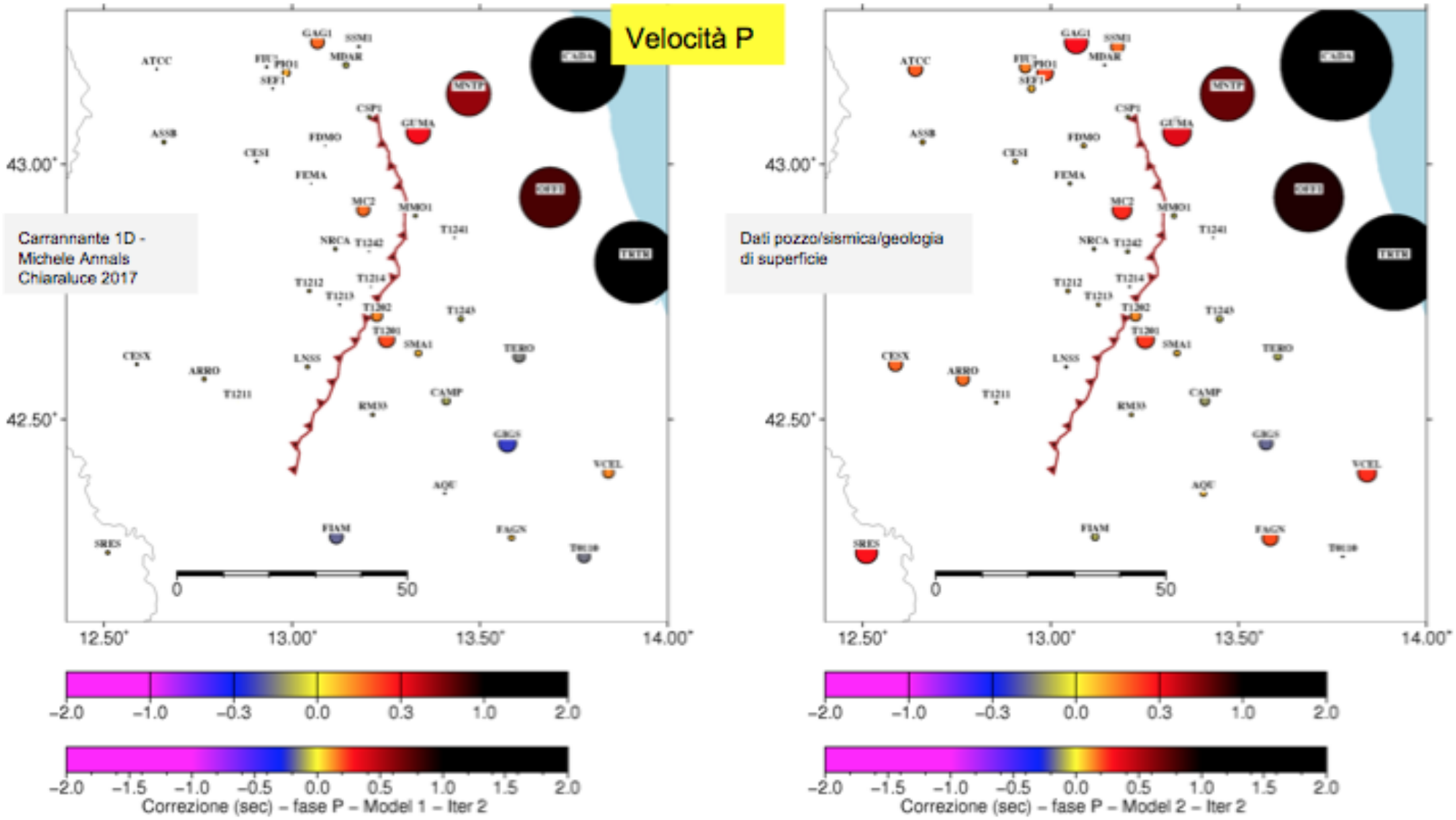
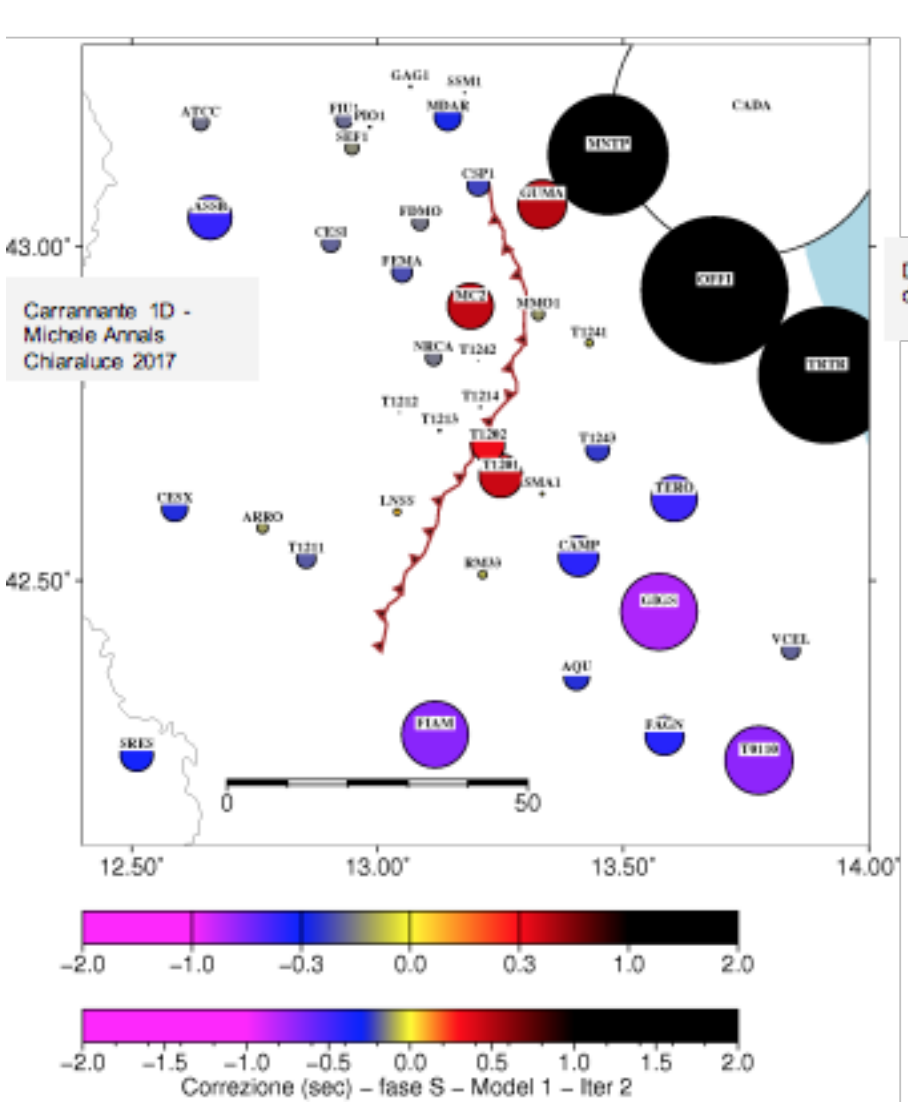
DI GEOFISICA E VULCANOLOGIA

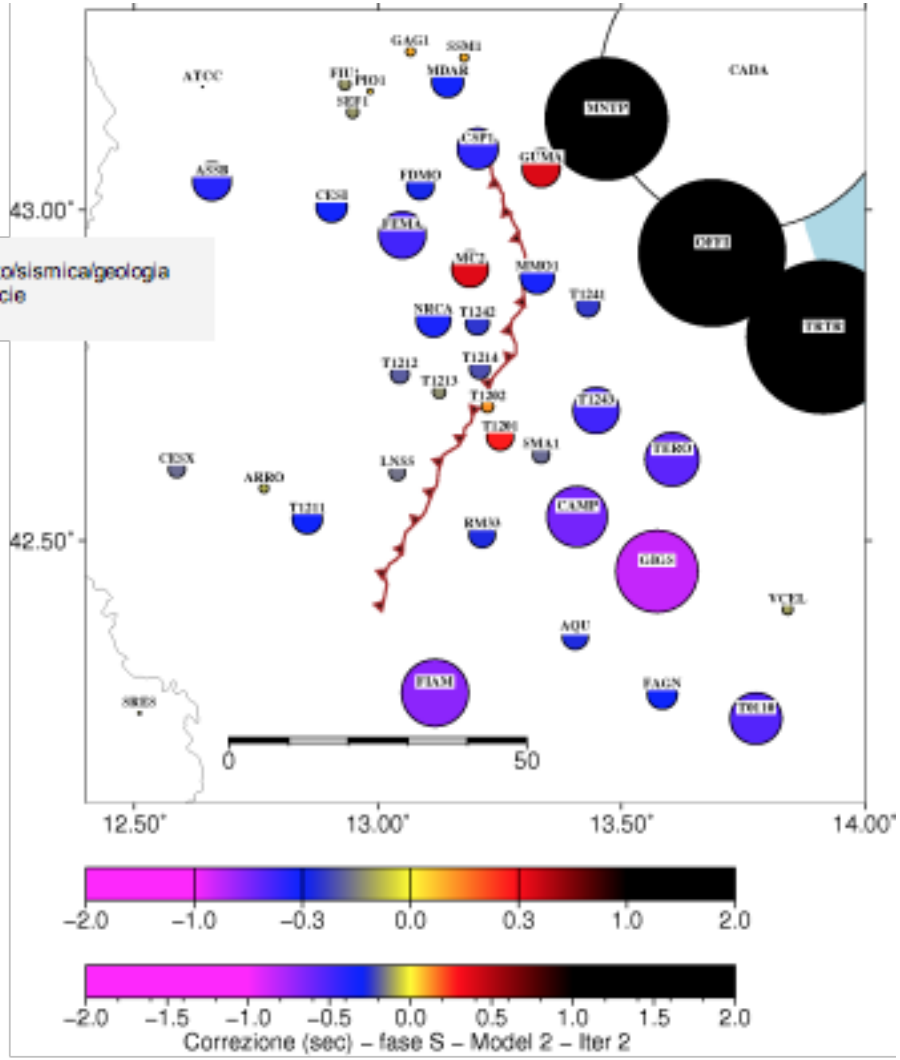
The study is in preparation as Improta et al. + **Bollettino Sismico Italiano working group**

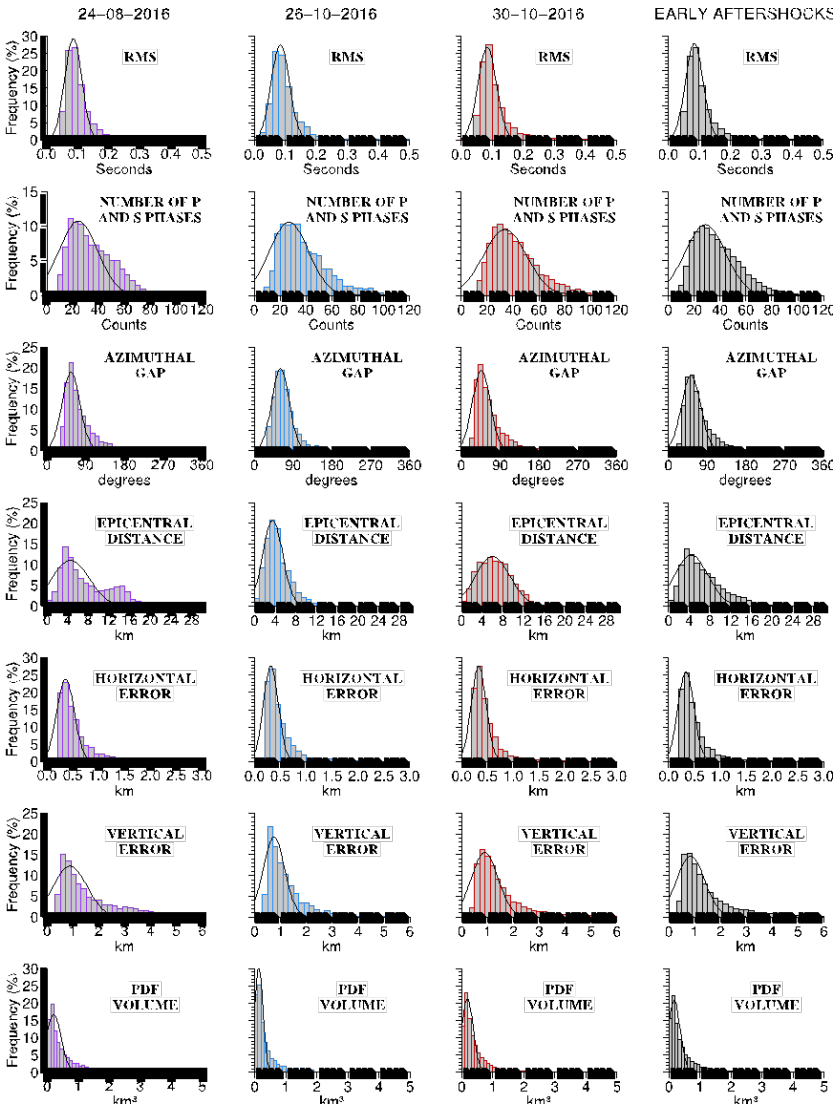


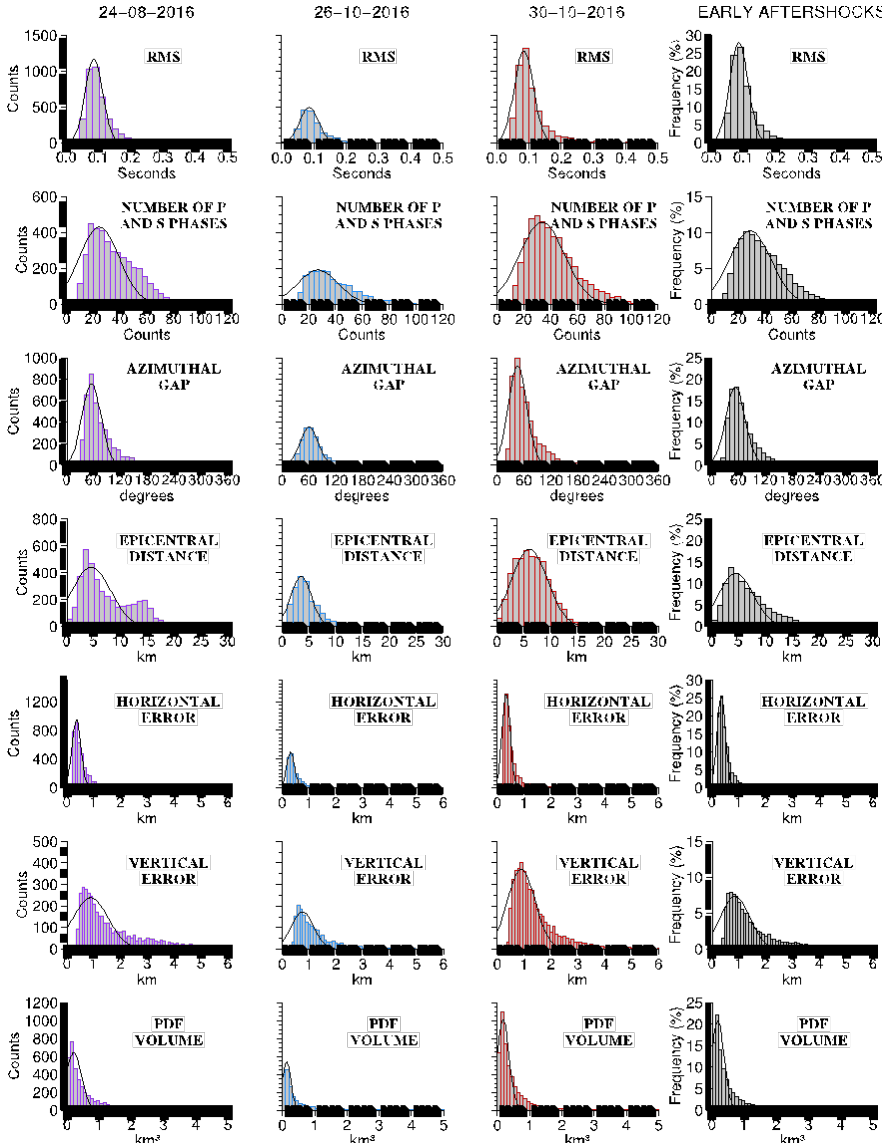

Velocità P
Carrannante 1D -
Michele Annals
Chiaraluce 2017
Dati pozzo/sismica/geologia
di superficie
43.00°
42.50°
12.50°
13.00°
13.50°
14.00°
0
50
−2.0 −1.0 −0.3 0.0 0.3 1.0 2.0
−2.0 −1.5 −1.0 −0.5 0.0 0.5 1.0 1.5 2.0
Correzione (sec) – fase P – Model 1 – Iter 2
Correzione (sec) – fase P – Model 2 – Iter 2



Dati pozzo/sismica/geologia di superficie




24–08–2016
26–10–2016
30–10–2016
EARLY AFTERSHOCKS
RMS
NUMBER OF P AND S PHASES
AZIMUTHAL GAP
EPICENTRAL DISTANCE
HORIZONTAL ERROR
VERTICAL ERROR
PDF VOLUME
Frequency (%)
Counts
Seconds
degrees
km
km³


24–08–2016
26–10–2016
30–10–2016
EARLY AFTERSHOCKS
RMS
NUMBER OF P AND S PHASES
AZIMUTHAL GAP
EPICENTRAL DISTANCE
HORIZONTAL ERROR
VERTICAL ERROR
PDF VOLUME
Counts
Frequency (%)
Seconds
degrees
km
km³